

Ample evidence exists from human studies that vitamin D reduces the risk of selected bacterial and viral infections

The recent paper by Bruce *et al.*¹ stated: 'At present, there is not adequate information available to claim vitamin D as an anti-infective agent. ... There are no data to support any relationship between vitamin D and host resistance to influenza. At this time it would be premature to suggest that vitamin D might be useful to improve host resistance to TB, influenza or any other infectious organism.' In making these statements, the authors rely on their knowledge of relevant animal experiments and likely mechanisms but overlook relevant human studies.

There have been two successful randomized controlled trials of vitamin D supplementation and reduced risk of influenza. The first, involving African-American postmenopausal women living in New York State, found a 60% reduced incidence of colds and influenza for those women taking 800 IU/d of vitamin D, and a 90% reduction for those women taking 2000 IU/d of vitamin D.² See, also, the discussion in Cannell *et al.*³ The second, involving 334 school children in Japan, half taking 1200 IU/d of vitamin D3, half taking 200 IU/d of vitamin D3, found a relative risk of 0.36 (95% confidence interval, 0.17, 0.79, $P = 0.006$) for those not taking additional vitamin D i.e. a 64% reduced risk for type A influenza.⁴ No effect of vitamin D was found for type B influenza, which is generally less common than type A influenza.

In a prospective observational study in Connecticut involving 198 healthy adults during the fall-winter 2009–2010 season, serum 25-hydroxyvitamin D [25(OH)D] levels ≥ 38 ng/mL were associated with a significant ($P < 0.0001$) two-fold reduction in the risk of developing acute respiratory tract infections and with a marked reduction in the percentages of days ill.⁵

A common cause of death after influenza infection is from bacterial pneumonia. In an ecological study, it was shown that an index of solar ultraviolet-B dose explained 46% of the variance for influenza case fatality rates in 12 communities of the USA during the 1918–1919 pandemic A (H1N1) influenza.⁶ The mechanisms proposed were reduction in the production of proinflammatory cytokines, which could also explain some of the benefits of vitamin D since H1N1 infection gives rise to a cytokine storm and in reducing secondary bacterial infections.

In 2009, pregnant women and immunosuppressed patients had increased risk of severe A (H1N1) influenza.⁷ Pregnancy and indigenous status were associated with severe influenza in Australia.⁸ One of the reasons pregnancy increases risk is general low serum 25(OH)D levels. Vitamin D deficiency

is common in pregnant women (5–50%) and in breastfed infants (10–56%), despite the widespread use of prenatal vitamins, because these are inadequate to maintain normal serum 25(OH)D levels (≥ 32 ng/mL).⁹ Australian Aborigines also have low serum 25(OH)D levels.¹⁰

There is good evidence that vitamin D reduces the risk of sepsis based on an investigation of the mechanisms,¹¹ an analysis of the epidemiological factors in the USA (geographic variation, seasonal variation, racial disparities and co-morbid diseases)¹² and an observational study in an intensive care unit.¹³

Thus, there is ample evidence that vitamin D reduces the risk of both bacterial and viral infections.

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REFERENCES

- 1 Bruce D, Ooi JH, Yu S, Cantorna MT. Vitamin D and host resistance to infection? Putting the cart in front of the horse. *Exp Biol Med* (Maywood) 2010;235:921–7
- 2 Aloia JF, Li-NG M. Re: epidemic influenza and vitamin D. *Epidemiol Infect* 2007;135:1095–6; author reply 1097–8
- 3 Cannell JJ, Zasloff M, Garland CF, Scragg R, Giovannucci E. On the epidemiology of influenza. *Virol J* 2008;5:29
- 4 Urashima M, Segawa T, Okazaki M, Kurihara M, Wada Y, Ida H. Randomized trial of vitamin D supplementation to prevent seasonal influenza A in schoolchildren. *Am J Clin Nutr* 2010;91:1255–60
- 5 Sabetta JR, DePetrillo P, Cipriani RJ, Smardin J, Burns LA, Landry ML. Serum 25-hydroxyvitamin d and the incidence of acute viral respiratory tract infections in healthy adults. *PLoS One* 2010;5:e11088.
- 6 Grant WB, Giovannucci D. The possible roles of solar ultraviolet-B radiation and vitamin D in reducing case-fatality rates from the 1918–1919 influenza pandemic in the United States. *Dermato-Endocrinology* 2009;1:215–9
- 7 Lapinsky SE. H1N1 novel influenza A in pregnant and immunocompromised patients. *Crit Care Med* 2010;38(4 Suppl):e52–7
- 8 Kelly H, Mercer G, Cheng A. Quantifying the risk of pandemic influenza in pregnancy and Indigenous people in Australia in 2009. *Euro Surveill* 2009;14. pii: 19441
- 9 Holmes VA, Barnes MS, Alexander HD, McFaul P, Wallace JM. Vitamin D deficiency and insufficiency in pregnant women: a longitudinal study. *Br J Nutr* 2009;102:876–881

- 10 Benson J, Wilson A, Stocks N, Moulding N. Muscle pain as an indicator of vitamin D deficiency in an urban Australian Aboriginal population. *Med J Aust* 2006;**185**:76–7
- 11 Mookherjee N, Rehaume LM, Hancock RE. Cathelicidins and functional analogues as antiseptics molecules. *Expert Opin Ther Targets* 2007;**11**:993–1004
- 12 Grant WB. Solar ultraviolet-B irradiance and vitamin D may reduce the risk of septicemia. *Dermato-Endocrinology* 2009;**1**:37–42
- 13 Jeng L, Yamshchikov AV, Judd SE, Blumberg HM, Martin GS, Ziegler TR, Tangpricha V. Alterations in vitamin D status and anti-microbial peptide levels in patients in the intensive care unit with sepsis. *J Transl Med* 2009;**7**:28